flow director

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 872 694 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
02.11.2000 Bulletin 2000/44

(43) Date of publication A2:
21.10.1998 Bulletin 1998/43

(21) Application number: **98106736.6**

(22) Date of filing: **14.04.1998**

(51) Int. Cl.[7]: **F24F 13/06**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **14.04.1997 GB 9707537**

(71) Applicant:
Waterloo Air Management Plc
Maidstone, Kent ME20 7NB (GB)

(72) Inventor: **Rolando, Paul Alan**
South Benfleet, Essex SS7 5SN (GB)

(74) Representative:
Wake, Steven John
Forrester & Boehmert,
Franz-Joseph-Strasse 38
80801 München (DE)

(54) Heating, ventilating and air conditioning systems

(57) A heating ventilating and air conditioning system comprises a diffuser which serves when mounted adjacent the outlet of the system in a first orientation to diffuse air in a generally horizontal direction and, when mounted in an inverted orientation, to diffuse air in a substantially vertical direction. The diffuser takes the form of a disc-like element which is mounted within an opening (2) defined in a mounting frame (3), co-operating means being provided for releasably retaining the diffuser in position within the opening. The diffuser is located within the opening with minimum clearance and the releasable retaining means serve to prevent undesired removal of the diffuser by hand without the use of a special tool. The system includes first and second components defining a plurality of similarly sized apertures with the components being mounted adjacent each other and movable to provide differing degrees of alignment between the apertures in order to control a flow of air through the components. Means are provided for releasably fixing the positions of the first and second components relative to each other to set a desired airflow rate, said means permitting the removal of one of the components and being such that the removed component can only be replaced in the same position, relative to the other component, as that from which it was removed thereby ensuring that the desired airflow rate is maintained. The system includes a plenum chamber (7) which is connected to a further component of the system by way of a substantially air-tight snap fitting connection.

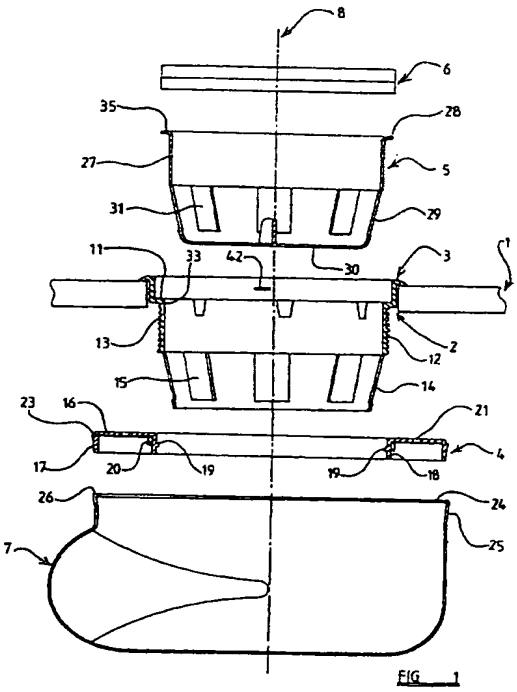

FIG 1

EP 0 872 694 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 10 6736

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 3 736 858 A (MERCIER J) 5 June 1973 (1973-06-05) * column 1, line 41 - line 45; figures 2,3 * ---	1	F24F13/06
D,A	EP 0 446 557 A (HESCO PILGERSTEG AG) 18 September 1991 (1991-09-18) * abstract; figures 1-8 * ---	1	
A	US 3 364 841 A (UCHIYAMA YOICHI) 23 January 1968 (1968-01-23) * column 5, line 69 - column 6, line 4; figures 10-15 * ---	1	
A	GB 682 148 A (AKTIEBOLAGET ENKÖPINGS VERKSTADER) 5 November 1952 (1952-11-05) * the whole document * ---	1	
A	DE 44 05 867 C (KRANTZ TKT GMBH) 22 June 1995 (1995-06-22) * figure 3 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F24F

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 April 2000	Mootz, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 98 10 6736

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1 - 8

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 98 10 6736

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-8

   Air diffuser comprising a plate-like element fixed in two alternative orientations

2. Claims: 9-15

   Mounting arrangement for air diffuser

3. Claims: 16-19

   Airtight snap fitting connection for air diffuser plenum chamber

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 10 6736

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3736858 A	05-06-1973	FR 2082702 A	10-12-1971
		DE 2114297 A	30-09-1971
		GB 1351474 A	01-05-1974
EP 0446557 A	18-09-1991	CH 680685 A	15-10-1992
		AT 106533 T	15-06-1994
		DE 59005946 D	07-07-1994
		FI 904263 A	15-09-1991
		NO 903336 A	16-09-1991
US 3364841 A	23-01-1968	NONE	
GB 682148 A		NONE	
DE 4405867 C	22-06-1995	AT 192229 T	15-05-2000
		DE 59508208 D	31-05-2000
		EP 0669503 A	30-08-1995
		ES 2146671 T	16-08-2000
		JP 7260241 A	13-10-1995
		SG 64285 A	27-04-1999
		US 5556330 A	17-09-1996

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 872 694 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.10.1998 Bulletin 1998/43

(51) Int. Cl.[6]: **F24F 13/06**

(21) Application number: **98106736.6**

(22) Date of filing: **14.04.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **14.04.1997 GB 9707537**

(71) Applicant:
Waterloo Air Management Plc
Maidstone, Kent ME20 7NB (GB)

(72) Inventor: **Rolando, Paul Alan**
South Benfleet, Essex SS7 5SN (GB)

(74) Representative:
Wake, Steven John
Forrester & Boehmert,
Franz-Joseph-Strasse 38
80801 München (DE)

(54) Heating, ventilating and air conditioning systems

(57) A heating ventilating and air conditioning system comprises a diffuser which serves when mounted adjacent the outlet of the system in a first orientation to diffuse air in a generally horizontal direction and, when mounted in an inverted orientation, to diffuse air in a substantially vertical direction. The diffuser takes the form of a disc-like element which is mounted within an opening (2) defined in a mounting frame (3), co-operating means being provided for releasably retaining the diffuser in position within the opening. The diffuser is located within the opening with minimum clearance and the releasable retaining means serve to prevent undesired removal of the diffuser by hand without the use of a special tool. The system includes first and second components defining a plurality of similarly sized apertures with the components being mounted adjacent each other and movable to provide differing degrees of alignment between the apertures in order to control a flow of air through the components. Means are provided for releasably fixing the positions of the first and second components relative to each other to set a desired airflow rate, said means permitting the removal of one of the components and being such that the removed component can only be replaced in the same position, relative to the other component, as that from which it was removed thereby ensuring that the desired airflow rate is maintained. The system includes a plenum chamber (7) which is connected to a further component of the system by way of a substantially air-tight snap fitting connection.

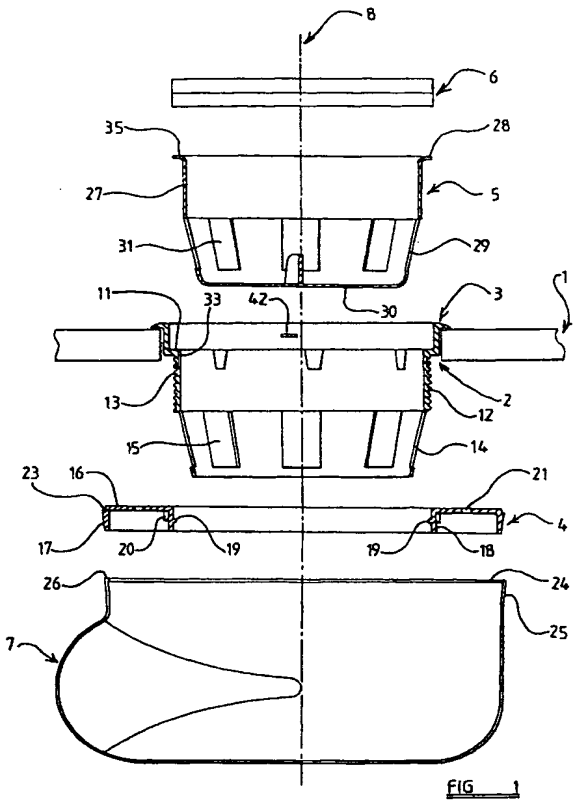

FIG 1

EP 0 872 694 A2

Description

THE PRESENT INVENTION relates broadly to the area of heating, ventilating and air conditioning systems and more particularly to an apparatus for directing and regulating the flow of air from an outlet of the heating, ventilating or air conditioning system into a room space.

At an outlet of a heating, ventilating or air conditioning system air will typically pass from ducting along which it has been conveyed through a plenum chamber, which may be regarded as a box which acts as an air buffer, through some form of damping arrangement which serves to regulate the flow of air through the outlet and a grille or diffuser which serves to direct the flow of air so that it moves in a desired direction as it enters the space to be ventilated. It is the grille or diffuser which is visible within the room which is being ventilated.

The present invention is particularly concerned with apparatus for directing and regulating the flow of air at an outlet which incorporates a diffuser and is particularly suited for use with an arrangement mounted in a floor. Circular floor outlets are being used in increasing numbers for underfloor supply and displacement based systems. The floor diffusers are mounted within an aperture in a floor tile so as to be substantially flush with the floor surface.

Such floor diffusers need to be adjustable so as to provide variable flow rates and variable air discharge patterns. This is because it is relatively common for larger working spaces to be sub-divided and rearranged at various times thereby necessitating the adaption of the room ventilation system to suit the particular room design and positioning of employees etc. It is known to provide an adjustable floor diffuser of this type and one design of such a diffuser is disclosed in EP-A-0446557. Whilst the diffuser shown in that specification provides for adjustable air discharge patterns and flow rates, the adjustment of the air discharge pattern requires the careful adjustment of two plates which make up the diffuser relative to one another and the fixing of the two plates in position. The adjustment of the air discharge pattern is therefore not a totally straightforward task. Whilst it is desirable to be able quickly and simply to dismantle the diffuser and adjust the air discharge pattern, it is not desirable that the diffuser should be readily removable from its flush-mounted position within the floor by hand.

A problem which has been encountered with existing designs of floor diffusers is that the damper is constituted by aligned apertures provided in a dirt tray and a mounting frame, with the aligned apertures being adjustable relative to each other to vary the degree of damping (i.e. the air flow rate). In previous designs whilst the appropriate degree of air damping could be set upon installation of the apparatus it has been found that when the dirt tray is removed for cleaning or maintenance purposes it is commonly replaced in the incorrect position so that the degree of air damping is no longer as desired. In addition, the assembly and dismantling of prior art apparatus of this type has not been entirely straightforward, thereby necessitating the attendance of skilled personnel to effect cleaning and maintenance tasks.

The present invention seeks to provide an improved apparatus for directing and regulating the flow of air from an outlet of a heating, ventilating or air conditioning system.

One aspect of this invention provides a diffuser for use adjacent an outlet of a heating, ventilating or air conditioning system, the diffuser comprising a plate-like element having a pair of opposed, exposed surfaces, the plate-like element defining apertures to permit a flow of air therethrough and having means for releasably fixing the element in an opening constituting the outlet of the heating, ventilating or air conditioning system, each aperture through the diffuser meeting the opposed, exposed surfaces at differing angles to the two surfaces, the releasable fixing means permitting fixing of the diffuser within said opening in two alternative orientations, the arrangement being such that in a first orientation air is diffused through one of the opposed, exposed surfaces in a first direction and in an inverted orientation air is diffused through the other of the opposed, exposed surfaces in a second, different direction.

Preferably each aperture through the diffuser element has first and second portions, the first portion of the aperture meeting its associated exposed surface at an angle of less than 60 degrees to that surface so as to provide a generally horizontal air discharge pattern when in use with air discharging from the diffuser through that first portion of the aperture and the second portion of the aperture meeting its associated exposed surface at an angle greater than 60 degrees to that surface so as to provide a generally vertical air discharge pattern when in use with air being discharged from the diffuser through that second portion of the aperture.

Conveniently each aperture has a portion meeting one exposed surface at an angle of approximately 50 degrees to the horizontal and a portion meeting the other exposed surface at an angle of approximately 71 degrees to the horizontal.

Advantageously each aperture has a portion which converges in the direction in which air flows through the aperture when air discharges from the diffuser through that portion of the aperture.

Preferably the plate-like diffuser element is formed as two halves which are permanently interconnected, the two halves comprising a top plate and a bottom plate, each half defining one of the opposed, exposed surfaces, the first and second portions of each aperture being formed in respective halves of the diffuser element.

At the junction between the two halves of the diffuser element, each aperture through the diffuser may

define a step or discontinuity for creating turbulence in a flow of air through the aperture.

The diffuser may be provided in combination with a mounting frame, the mounting frame defining the opening constituting the outlet of the heating, ventilating or air conditioning system, the releasable fixing means comprising a snap-fitting arrangement permitting the releasable fixing of the diffuser within the mounting frame in either of said two alternative orientations.

Conveniently when mounted in the frame, the outwardly direct, exposed surface of the diffuser lies substantially flush with the frame and with minimum clearance between the diffuser and the frame to prevent removal of the diffuser from the frame other than by using a tool designed for the removal of the diffuser.

A second aspect of this invention provides a mounting arrangement for mounting a diffuser adjacent an outlet of a heating, ventilating or air conditioning system, the arrangement comprising a diffuser in the form of a plate-like element defining apertures to permit a flow of air therethrough and a mounting frame locatable adjacent the outlet of the heating, ventilating or air conditioning system, the mounting frame defining an opening for receiving the diffuser with minimal clearance between the diffuser and the frame, the diffuser and the frame being formed with co-operating means for releasably retaining the diffuser in position with the aperture within the mounting frame to prevent undesired removal of the diffuser by hand without the use of a tool for releasing the retaining means.

Preferably the diffuser has an outwardly directed, exposed surface which lies substantially flush with the outwardly directed surface of the mounting frame when the diffuser is received within the mounting frame, the arrangement being such that no part of the diffuser upon which purchase can be gained is exposed.

Conveniently the diffuser defines an internal, undercut recess to which access is gained via an aperture in the diffuser, a hook-like tool being provided, part of the tool being adapted to engage said undercut recess to enable the diffuser to be removed from the opening defined by the frame.

A third aspect of this invention provides an apparatus for directing and regulating a flow of air from an outlet of a heating, ventilating or air conditioning system, the apparatus comprising a first component defining a plurality of apertures to permit a through flow of air, a second component defining a plurality of apertures of similar size to the apertures in the first component and also to permit a through flow of air, the first and second components being mounted adjacent each other and being movable relative to each other such that the apertures can be moved between positions of differing degrees of alignment to regulate a flow of air through the two components, means being provided for releasably fixing the first and second components relative to each other to give a desired degree of alignment between the apertures in the first and second components and thereby give a desired air flow rate, said releasable fixing means permitting removal of one component from its position adjacent the other component for maintenance or the like purposes, the fixing means being such that the removed component can only be replaced in the same position relative to the other component as that from which it was removed thereby ensuring that the desired air flow rate setting is maintained.

Preferably the releasable fixing means comprise a peg mountable at one of a plurality of positions on the first component, the locations corresponding to different degrees of alignment between the apertures in the first and second components and an opening in part of the second component, the arrangement being such that when the peg is mounted at one of said locations on the first component part of the peg projects upwardly such that the second component can only be mounted adjacent the first component in one predetermined position in which the projecting part of the peg extends into the opening formed in the second component.

Conveniently the plurality of locations defined by the first component comprise a plurality of dovetail sectioned slots and the peg comprises a dovetail-sectioned peg designed to be received in the slots, the peg having a head which projects beyond the end of the slot to form the projecting portion which is received within the opening in the second component.

Advantageously the plurality of locations at which the peg may be mounted on the first component are off-set from one another by a differing amount to that by which the apertures in the first and second components are off-set from one another such that the repositioning of the peg from one location to the next provides a change in the degree of alignment of the apertures in the first and second components.

A fourth aspect of this invention provides an apparatus for directing a flow of air from an outlet of a heating, ventilating or air conditioning system, the apparatus comprising a plenum chamber and one or more further components disposed between the plenum chamber and the outlet, the plenum chamber having an inlet adapted to be connected to ducting of the heating, ventilating or air conditioning system so as to receive air supplied via the ducting, the plenum chamber also having an outlet through which air flows from the chamber to a further component forming part of the apparatus, the plenum chamber and the further component having co-operating means forming a substantially airtight snap fitting connection between the outlet of the plenum chamber and the further component.

Preferably the means forming the substantially airtight snap fitting connection between the outlet of the plenum chamber and the further component comprise a co-operating resilient lip and a step or recess formed on the plenum chamber and the further component, movement of the plenum chamber and the further component into engagement with each other serving automatically

to cause the lip to become captively engaged behind the step or recess thereby connecting the outlet of the plenum chamber to the further component.

Conveniently the lip is formed around the periphery of the plenum chamber outlet and the step is defined by the further component to which the plenum chamber is to be connected.

Advantageously the plenum chamber has a substantially circular outlet and the step or recess is defined in an outwardly directed surface of a corresponding, annular part of the further component, the annular part of the further component widening in the direction in which the plenum chamber is moved into engagement therewith such that the resilient lip flexes outwardly as the plenum chamber and the further component are moved together prior to snap-fitting into the step or recess.

In order that the present invention may be more readily understood and so that further features thereof may be appreciated the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is an exploded cross-sectional view of an apparatus for directing and regulating the flow of air from an outlet of a heating, ventilating or air conditioning system;

FIGURE 2 shows the apparatus of Figure 1 when in an assembled condition;

FIGURE 3 is a schematic perspective view of a diffuser forming one aspect of the present invention;

FIGURE 4 is a partial cross-sectional view taken on the line IV-IV in Figure 3, illustrating features adjacent the periphery of the diffuser;

FIGURE 5 is a rough plan view of that part of the apparatus illustrated in the right hand portion of Figure 4;

FIGURE 6 is a cross-sectional view taken on the line VI-VI in Figure 3;

FIGURE 7 is a view corresponding to Figure 6 but showing the diffuser in an inverted orientation; and

FIGURES 8 and 9 are cross-sectional views through part of an alternative arrangement used for mounting the apparatus in a concrete slab floor.

Referring initially to Figure 1 of the drawings there is shown an apparatus for directing and regulating the flow of air from an outlet of a heating, ventilating or air conditioning system where the apparatus is designed to be mounted in a floor. A floor tile is illustrated schematically as reference numeral 1 and defines a circular aperture 2 designed to receive the apparatus. The apparatus generally comprises a mounting frame 3, part of which is threaded and which carries a threaded mounting collar 4. The mounting frame 3 is passed into the hole 2 in the floor tile 1 from above whilst the mounting collar 4 is screwed onto the threaded part of the mounting frame from beneath and may thereby be moved up such that the floor tile is sandwiched between an upper part of the mounting frame 3 and the mounting collar 4.

A damper/dirt tray 5 is received within the mounting frame 3 and a diffuser disc 6 sits on top of the uppermost rim of the damper/dirt tray 5 and extends across the opening defined at the top of the mounting frame 3. A plenum box 7 is mounted on the outer edge of the mounting collar 4 and is positioned beneath the floor tile and has means for connection to ducting or the like by way of which air is conveyed to the outlet where the apparatus is installed. The complete apparatus is centrally located with respect to the central axis 8 of the aperture 2 and is of generally "circular" form in plan view.

Looking at the individual components of the apparatus in more detail, the mounting frame 3 is generally circular in plan view and has an upper portion bounded by an upstanding wall 9 which is formed, at its upper end, with an outwardly directed lip or flange 10. The upper portion is designed to accommodate the diffuser disc 6. The wall 9 extends, at its lower end, inwardly such that a step 11 is defined at a junction between the upper wall 9 and a central wall 12 which is formed with an external thread 13. At its lower end the central wall 12 leads into a lower portion of the mounting frame which comprises a wall 14 which extends downwardly and inwardly and which defines eight generally rectangular air inlet apertures 15 which are equally spaced, in a circumferential direction, around the wall 14.

The upper portion of the mounting frame 3 is so designed that it will pass through the aperture 2 formed in the floor tile 1 with the wall 9 accommodated within the aperture and the lip or flange 10 seated upon the upper surface of the floor tile in order to "suspend" the frame from the floor tile. The threaded wall 12 in the central region of the mounting frame 3 is designed to receive the mounting collar 4, which takes the form of an annular component which, at any one point around the annulus, is of generally inverted U-shaped cross-section, as can clearly be seen in Figure 1.

Thus the mounting collar 4 defines an annular upper surface 16 having a depending outer wall 17 and a depending inner wall 18, the inner wall 18 being formed, on its inwardly directed surface, with a single screw thread which, in section, resembles a tooth 19 which co-operates with the external thread 13 on the wall 12 of the mounting frame to enable the collar 4 to be connected with the mounting frame by way of the co-operating screw threads. The mounting collar 4 may therefore be threaded onto the frame 3 and rotated in order to move the collar up towards the floor tile 1 until it

reaches the position shown in Figure 2 where the floor tile is effectively "clamped" between the flange or lip 10 at the uppermost edge of the frame 3 and the mounting collar 4.

To facilitate the rotation of the mounting collar a plurality of generally radially outwardly extending webs 20 are provided on the outwardly directed surface of the wall 18 of the mounting collar 4 such that they are accommodated within the U-section thereof. Four such "finger webs" 20 may be provided.

The upper surface 16 of the mounting collar 4 is provided with four equally spaced apertures 21 at approximately central positions between the walls 17 and 18, the apertures 21 being designed to receive fixing screws 22 or the like (see Figure 2) which are passed through the collar and extend into the floor tile 1 in order to fix the collar to the floor tile.

Around its periphery at the junction between the upper surface 16 and the outermost depending wall 17 the mounting collar is formed with a cut away recess or step 23, by means of which the plenum chamber is mounted thereon. The plenum chamber 7 is generally of circular form in plan elevation having a scroll-type inlet adapted to be connected to ducting through which air is conveyed towards the outlet where the apparatus is to be mounted. The plenum chamber has an outlet 24 which is circular and which is designed to be mounted on the collar 4. The outer wall of the plenum chamber 7 extends outwardly slightly, as identified at reference numeral 25, as it extends towards the outlet 24 and terminates with an inwardly directed lip 26 which is designed to sit within the recess 23 defined at the outer periphery of the mounting collar 4. The plenum chamber 7 is designed to be snap-fitted onto the mounting collar and for this purpose the depending outer wall of the collar 4 is of slightly lesser thickness at its lower, free edge than at its upper edge where the recess 23 is defined.

The plenum chamber 7 is mounted on the collar 4 by aligning the outlet 24 of the plenum chamber with the mounting collar so that the depending wall 17 passes into the outlet 24. The inwardly directed lip 26 engages the outer surface of the depending wall 17 and the wall of the plenum chamber 7 is deformed outwardly as the chamber is pushed upwards and onto the mounting collar 4 until the lip 26 snaps into the recess 23 whereupon the plenum chamber 7 is firmly mounted upon the collar 4. The inherent resilience of the plastics material from which the plenum chamber 7 is moulded permits flexing of its outer wall so that it can be mounted on the collar 4 in the manner described.

Looking now at the components shown above the floor tile 1 in Figure 1 of the drawings, it will be seen that the damper/dirt tray or basket 5 is of similar general form to the mounting frame 3 and is designed to be received within the mounting frame 3. Thus the basket 5 is of generally circular form in plan view and has an upper wall 27 formed at its uppermost edge with an outwardly directed flange 28. The upper wall extends, at its lower edge, into a downwardly and inwardly extending lower wall 29 which leads into a base 30 which closes off the bottom of the basket 5. The basket 5 is, as mentioned, designed to be received within the mounting frame and is configured such that upon insertion into to the mounting frame 3 the flange 28 rests upon the step 11 defined by the mounting frame so that the basket is suspended within the mounting frame. When inserted in this position the wall 27 is aligned adjacent the wall 12 of the mounting frame whilst the wall 29 is disposed immediately adjacent the wall 14 of the mounting frame.

The wall 29 defines eight air inlet apertures 31 which are of rectangular configuration and are equally spaced around the periphery of the wall at 45 degree pitch. Each aperture 31 has a circumferential extent of approximately 18 degrees. The apertures 31 are of substantially the same size and form as the apertures 15 in the wall 14 of the mounting frame 3. Thus, when the basket 5 is received within the mounting frame 3 the apertures 31 are designed to be aligned, in a vertical direction, with the apertures 15. Rotation of the basket 5 within the mounting frame 3 allows the apertures 31 to be moved with respect to the apertures 15 between fully aligned positions where fully open apertures are produced and off-set positions where the material between the apertures 31 serve partially or fully to close off the apertures 15. Thus the rotation of the basket 5 within the mounting frame 3 allows the variation of the degree of damping i.e. control of the air flow rate through the apparatus.

The base 30 of the basket 5 defines a T-shaped upstanding tab 32 which is provided as an aid to assist in pulling out the basket 5 from within the frame 3.

The basket 5 and the mounting frame 3 are provided with means for releasably fixing the position of the basket 5 within the frame 3 so as to provide a desired degree of damping or air flow rate. The releasable fixing means comprise eight dovetail slots 33 which extend downwardly in the inwardly directed surface of the wall 12 of the frame 3 from its upper edge. The eight dovetail slots 33 are spaced around the internal surface of the wall 12. The circumferential spacing between all bar two of the slots is 48.2 degrees with the spacing between the final two slots being 22.6 degrees. It will be appreciated that with the apertures 31 and 15 being spaced around the basket 5 and mounting frame 3 at 45 degree spacings, the locations of the dovetail slots do not correspond precisely with the locations of the apertures.

The slots 33 are designed so as to receive a dovetail peg 34 (see Figure 2). The dovetail peg 34 carries an enlarged head at its upper end which projects above the level of the step 11 defined by the mounting frame 3 and is designed to be received within a single aperture 35 which extends through the flange 28 defined at the upper rim of the basket 5. When the apparatus is assembled in the manner as shown in Figure 2 with the peg 34 located in one of the dovetail slots 33 so that its

head is accommodated within the aperture 35 in the rim of the basket 5, the basket 5 cannot be rotated relative to the mounting frame 3 but can still be lifted out of the frame 3. Thus it will be appreciated that the dovetail slots 33, the peg 34 and the aperture 35 in the basket 5 serve to lock the basket 5 in position relative to the frame 3 in such a way as to provide a predetermined degree of damping or air flow rate.

With the arrangement of the dovetail slots 33 being at different angular settings around the frame 3 to the apertures 15 the appropriate selection of one slot 33 to receive the peg 34 determines the degree of damping. Each slot 33 gives a gradually increased or decreased degree of damping. When the apparatus is initially assembled the appropriate degree of damping can be selected by locating the peg 34 in the appropriate slot 33. This then sets the degree of damping and even if the basket 5 is removed for cleaning or the like the peg 34 does not have to be removed and because the enlarged head of the peg 34 projects above the level of the step 11 defined by the mounting frame 3 the basket 5 can only be reintroduced into the frame 3 in the same position as that in which it was originally located i.e. in the position where the head of the peg 34 is received within the aperture 35 in the rim of the basket. Thus the desired degree of damping is maintained.

The diffuser 6 is of disc-like form having a diameter of approximately 200mm and a depth of approximately 20mm. The disc is formed as two halves, there being an upper half and a lower half each of approximate equal thickness. The two halves are formed as moulded plastics components which are then permanently bonded together to produce a single diffuser disc defining a plurality of apertures extending therethrough. Each half of the disc is moulded with co-operating pegs and recesses and one index peg and recess (of a different size to the remaining pegs and recesses) for correct mating. As mentioned above the diffuser disc 6 is designed to be received within the upper portion of the mounting frame 3.

Figure 3 is a schematic perspective view of the diffuser disc from which it can be seen that the disc has a circular central region 36 and a plurality of apertures 37, each of which extends at a tangent to the central part 36 of the disc. Every other tangentially extending aperture 37 is split into two parts, there being an inner part adjacent the central part 36 of the disc and an outer part which extends out towards the periphery of the disc. Thus in a circumferential direction every other aperture 37 is longer and split into two halves. There are a total of 24 tangentially extending apertures or airways 37 spaced circumferentially around the disc. The underside view of the disc corresponds to the view shown in Figure 3 insofar as the arrangement of the apertures 37 and the central part 36 of the disc are concerned.

The disc 6 is, as previously mentioned, designed to be accommodated within the upper portion of the mounting frame 3, seated upon the upper rim of the dirt tray 5, as illustrated in Figure 2. The disc 6 and the mounting frame 3 are provided with co-operating means for releasably retaining the disc 6 in position within the mounting frame. Thus, at one point on its periphery the disc 6 is provided with upper and lower projecting tabs 38, 39 with a shallow recess 40 therebetween. The tabs 38, 39 have a circumferential extent of approximately 13mm. Diametrically opposite the tabs 38, 39 the disc 6 is formed with a small circumferentially extending projection 41, having a circumferential extent of approximately 10mm. The mounting frame 3 is formed with a slot or aperture 42 which is designed to accommodate the projection 41. Thus the aperture 42 serves, when it receives the projection 41, to prevent rotational movement of the disc 6 within the mounting frame 3. Opposite the slot or aperture 42 the mounting frame 3 is provided with a resilient clip 43 in the form of a depending finger 44 having an enlarged, lower end 45. The finger 44 is, of course, free to move in the radial direction at its lower end. The junction between the wall 9 and the flange 10 of the mounting frame 3 defines a shallow recess or cut out 46 which is designed to accommodate the upper tab 38 formed on the disc 6.

It will be appreciated that to locate the disc 6 within the mounting frame 3 the disc is positioned such that the tabs 38, 39 are aligned with the clip 43 and the edge of the disc carrying the projection 41 is lowered into the space defined by the upper part of the mounting frame so that the projection 41 is received within the slot 42. The diametrically opposite edge is then pressed downwardly into the opening defined by the mounting frame, the lower tab 39 causing the resilient finger 44 of the clip 43 to deflect radially outwardly before it passes, as a snap-fitting, beneath the enlarged lower end 45 of the finger whereupon the upper tab 38 is accommodated within the cut away recess 46 at the upper edge of the mounting frame. The design is such that the disc is securely "clipped" into place and cannot rotate relative to the mounting frame due to the engagement of the projection 41 within the slot 42 with minimum clearance. In addition the upper surface of the disc 6 lies substantially flush with the top edge of the mounting frame 3 so as to prevent persons from tampering with the diffuser disc 6 and possibly removing it from its mounting location. Means are however provided for the removal of the disc 6 by authorised personnel.

Thus, adjacent the upper tab 38 and at the radially outer end of one of the apertures 37 a small recess 47 is defined within the body of the disc, the recess 47 being designed to receive a hooked end of a pull-out tool 48 which may be hooked onto the disc and used in order to pull it out of the mounting frame 3. As the disc is lifted upwardly the lower tab 39 once again causes the lower end of the resilient finger 44 to deflect radially outwardly whereupon it moves passed the enlarged head 45 so that the disc 6 may be "popped out" from the mounting frame 3.

Figure 6 illustrates, in cross-section, one of the

apertures 37 formed in the diffuser disc 6. As previously mentioned the disc 6 is formed in two halves which are permanently bonded together. Thus in Figure 6 the upper half of the disc is identified by reference numeral 49 whilst the lower half of the disc is identified by reference numeral 50. It will be observed that the part of the aperture 37 which extends through the upper half 49 of the disc 6 extends at an angle of approximately 50 degrees to the horizontal and has parallel side walls. In contrast, that part of the aperture 37 which passes through the lower part 50 of the disc 6 has non-parallel walls and extends, at the free face of the disc 6 at an angle of approximately 19 degrees to the vertical (71 degrees to the horizontal) whilst at the face which is bonded to the upper half of the disc 6 it extends at approximately 13 degrees to the vertical (77 degrees to the horizontal). Thus the part of the aperture 37 formed in the disc portion 50 converges towards the free face. It will also be observed that the two halves of the aperture 37 extend in opposite directions so that a flow of air is turned from one direction to another as it passes through the disc 6. Whilst the "forwardmost" walls of the upper and lower parts of the apertures 37 meet at an alignment point 51, it will be noted that the rearmost walls of the apertures 37 are off-set at the junction between the upper and lower parts of the disc 6 so that a step 52 is created. The presence of the step 52 serves to create turbulence within the flow of air, the turbulence providing improved air flow characteristics.

The arrows 53, 54 in Figure 6 illustrate the general direction in which air flows through the disc when the disc is mounted in the frame 3 in the orientation illustrated in Figure 6. It will be observed that air leaves the diffuser disc 6 in a generally horizontal direction as illustrated by the arrow 54. The disc 6 is designed to be mounted within the frame 3 either way up and Figure 7 is a cross-section through an aperture 37 when the disc is mounted in the frame 3 the other way up to that shown in Figure 6 so that what was the upper half 49 of the disc is located lowermost in Figure 7 whilst what was the lower half 50 of the disc is shown uppermost in Figure 7. The symmetrical arrangement of the tabs 38, 39, the clip 43 and the projection 41 and the slot 42 permit the mounting of the disc 6 either way up within the mounting frame 3.

It will be observed from Figure 7 that when mounted in the frame 3 in this particular orientation, the disc 6 provides for an air discharge in a substantially vertical direction, the flow of air being illustrated by the arrows 55, 56. Thus, by simply reversing the orientation of the disc 6 (using the pull-out tool 48) the air discharge pattern may be varied between a substantially horizontal discharge (as shown in Figure 6) and a substantially vertical discharge (as shown in Figure 7).

It is envisaged that the majority of the components of the apparatus may be formed from plastics materials. Thus, the mounting frame 3, the diffuser disc 6, the mounting collar 4 and the location peg 34 may be formed from polycarbonate whilst the damper/dirt tray 5 and the plenum 7 may be formed from polypropylene.

The apparatus is assembled by initially passing the mounting frame 3 through an opening formed in the floor tile 1 and then threading the collar 4 onto the frame 3 so that the tile 1 is sandwiched in position between the collar and the upper flange of the mounting frame. Screws 22 may then be passed through the collar to secure the arrangement in place with respect to the tile 1. The plenum 7 can then be simply snap-fitted onto the mounting collar 4 and ducting or the like may be mounted on the inlet of the plenum simply as a push fit. It is envisaged that the plenum inlet may have an initial relatively narrow portion which leads into a slightly wider inlet portion with the two portions being interconnected by a parting line. If the ducting which is to be connected to the plenum is of relatively narrow diameter then it may be push-fitted directly onto the initial inlet portion whereas if a larger diameter ducting is to be used then the initial relatively narrow inlet portion may be removed at the parting line so that the ducting can be push-fitted onto the relatively larger inlet portion.

The damper/dirt tray 5 is dropped into the mounting frame 3 and rotated to provide the desired degree of damping/air flow rate. The location peg 34 is then passed through the aperture 35 in the rim of the tray 5 and into one of the dovetail slots 33 formed in the mounting frame 3 thereby providing a predetermined location for the tray 5. The diffuser disc 6 is then snap-fitted into the opening at the upper end of the mounting frame 3 in the manner as described with reference to Figure 4, whereupon it is securely held in place but can, as mentioned, be removed by way of the pull out tool 48 when it is desired to invert the disc 6 to provide a different air discharge pattern. When the damper/dirt tray 5 needs to be removed for cleaning or maintenance purposes the disc 6 can simply be pulled out of the frame 3 using the tool 48. Following cleaning or maintenance the dirt tray 5 can only be replaced within the frame 3 in the same position as that in which it was initially located due to the presence of the upstanding location peg 34. This ensures that upon replacing the tray 5 the desired damper setting is retained. The damper setting can, of course, be adjusted by removing the peg 34, rotating the tray 35 to a new setting and replacing the peg 34, passing it through the aperture 35 in the rim of the tray 5 and into a different dovetail slot 33 in the wall of the frame 3.

It may be necessary in certain situations to mount the apparatus within a relatively deep concrete slab floor. This often presents difficulties and the apparatus is therefore designed with an alternative mounting arrangement for use with relatively deep concrete slab floors. The arrangement is illustrated in Figures 8 and 9 of the drawings. In Figures 8 and 9 a concrete slab floor is identified by reference numeral 57. It will be appreciated that it is not possible to pass screws through the mounting collar 4 into the concrete slab floor. Instead

the apparatus is fixed in position by means of a pair of mounting clamps 58, one of which is illustrated in each of Figures 8 and 9.

It will be appreciated that a pair of mounting clamps 58 are provided at diametrically opposed positions on the mounting frame 3.

Thus, at diametrically opposed positions the step 11 formed at the junction between the upper and middle portions of the mounting frame 3 defines bores 59 through which clamping bolts 60 are passed. The bores 59 are designed such that the head of a bolt 60 is retained within the bore with the threaded shank of the bolt passing down through the bore so as to be disposed adjacent the wall 12 of the mounting frame 3. At positions beneath the bores 59 the wall 12 defines recesses or cut away regions 61 each of which serves to receive a resilient spring steel mounting clamp 62. A clamping nut 63 is located on the end of each of the bolts 60. The resilient spring steel clamp 62 is configured such that its lower end engages and is urged against the nut 63 and such that as the bolt 60 is rotated in a clockwise direction the nut 63 rises up the threaded shank of the bolt and urges the lower end of the resilient clamp 62 radially outwardly. A lower region of the clamp 62 carries an outwardly directed barb or projection 64.

When assembling the apparatus using the arrangement shown in Figures 8 and 9 a sleeve or collar 65 is initially located within the aperture formed in the concrete slab 57, that sleeve or collar having a circumferentially extending recess or ridge 66 disposed at a position corresponding to the location of the barb 64 formed on the resilient clamp 62. When the apparatus is to be mounted in position the mounting frame 3 is dropped into the sleeve or collar with the mounting clamps 62 located thereon in the manner as shown in Figure 8. Each of the bolts 60 is then rotated so as to cause to the nut 63 to rise up the threaded shank until the position shown in Figure 9 is reached. This urges the lower end of the resilient clamp 62 radially outwardly until the barb 64 engages the recess 66 formed in the sleeve or collar 65 and is then retained captive in the recess. The clamping arrangement using the resilient clamps 62 locks the complete assembly in place in the sleeve within the aperture in the concrete slab floor.

The damper/dirt tray 5 may then be dropped into the mounting frame 3 in the usual way whereupon the upper rim of the tray 5 serves to conceal and extend over the top of the heads of the bolts 60. The diffuser disc 6 may then be mounted in place in the usual way and the threaded collar 4 can be located on the lower most end of the threaded wall 12 with the plenum connected thereto. It will be appreciated that the mounting arrangement described above provides a secure yet concealed fixing for locating the apparatus in position within a floor constituted by a relatively deep concrete slab.

From the description given above it will be apparent that the apparatus overcomes a number of problems associated with existing designs. In particular the design is "tamper proof" in that the diffuser disc 6 cannot be removed by hand without the use of the pull out tool. At the same time, however, it is possible simply and easily to vary the air discharge pattern by removing and turning over the disc 6 and to clean and maintain the damper/dirt tray region. In addition, the correct setting of the damper is automatically maintained by virtue of the "memory facility" constituted by the location peg 34 which ensures that the damper/dirt tray 5 can only be replaced within the mounting frame 3 in one predetermined position.

The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A diffuser for use adjacent an outlet of a heating, ventilating or air conditioning system, the diffuser comprising a plate-like element having a pair of opposed, exposed surfaces, the plate-like element defining apertures to permit a flow of air therethrough and having means for releasably fixing the element in an opening constituting the outlet of the heating, ventilating or air conditioning system, each aperture through the diffuser meeting the opposed, exposed surfaces at differing angles to the two surfaces, the releasable fixing means permitting fixing of the diffuser within said opening in two alternative orientations, the arrangement being such that in a first orientation air is diffused through one of the opposed, exposed surfaces in a first direction and in an inverted orientation air is diffused through the other of the opposed, exposed surfaces in a second, different direction.

2. A diffuser according to Claim 1 wherein each aperture through the diffuser element has first and second portions, the first portion of the aperture meeting its associated exposed surface at an angle of less than 60 degrees to that surface so as to provide a generally horizontal air discharge pattern when in use with air discharging from the diffuser through that first portion of the aperture and the second portion of the aperture meeting its associated exposed surface at an angle greater than 60 degrees to that surface so as to provide a generally vertical air discharge pattern when in use with air being discharged from the diffuser through that second portion of the aperture.

3. A diffuser according to Claim 2 wherein each aperture has a portion meeting one exposed surface at an angle of approximately 50 degrees to the horizontal and a portion meeting the other exposed sur-

face at an angle of approximately 71 degrees to the horizontal.

4. A diffuser according to Claim 2 or Claim 3 wherein each aperture has a portion which converges in the direction in which air flows through the aperture when air discharges from the diffuser through that portion of the aperture.

5. A diffuser according to Claim 2, 3 or 4 wherein the plate-like diffuser element is formed as two halves which are permanently interconnected, the two halves comprising a top plate and a bottom plate, each half defining one of the opposed, exposed surfaces, the first and second portions of each aperture being formed in respective halves of the diffuser element.

6. A diffuser according to Claim 5 wherein, at the junction between the two halves of the diffuser element, each aperture through the diffuser defines a step or discontinuity for creating turbulence in a flow of air through the aperture.

7. A diffuser according to any one of Claims 1 to 6 in combination with a mounting frame, the mounting frame defining the opening constituting the outlet of the heating, ventilating or air conditioning system, the releasable fixing means comprising a snap-fitting arrangement permitting the releasable fixing of the diffuser within the mounting frame in either of said two alternative orientations.

8. A diffuser according to Claim 7 wherein, when mounted in the frame, the outwardly direct, exposed surface of the diffuser lies substantially flush with the frame and with minimum clearance between the diffuser and the frame to prevent removal of the diffuser from the frame other than by using a tool designed for the removal of the diffuser.

9. A mounting arrangement for mounting a diffuser adjacent an outlet of a heating, ventilating or air conditioning system, the arrangement comprising a diffuser in the form of a plate-like element defining apertures to permit a flow of air therethrough and a mounting frame locatable adjacent the outlet of the heating, ventilating or air conditioning system, the mounting frame defining an opening for receiving the diffuser with minimal clearance between the diffuser and the frame, the diffuser and the frame being formed with co-operating means for releasably retaining the diffuser in position with the aperture within the mounting frame to prevent undesired removal of the diffuser by hand without the use of a tool for releasing the retaining means.

10. A mounting arrangement according to Claim 9 wherein the diffuser has an outwardly directed, exposed surface which lies substantially flush with the outwardly directed surface of the mounting frame when the diffuser is received within the mounting frame, the arrangement being such that no part of the diffuser upon which purchase can be gained is exposed.

11. A mounting arrangement according to Claim 9 or Claim 10 wherein the diffuser defines an internal, undercut recess to which access is gained via an aperture in the diffuser, a hook-like tool being provided, part of the tool being adapted to engage said undercut recess to enable the diffuser to be removed from the opening defined by the frame.

12. An apparatus for directing and regulating a flow of air from an outlet of a heating, ventilating or air conditioning system, the apparatus comprising a first component defining a plurality of apertures to permit a through flow of air, a second component defining a plurality of apertures of similar size to the apertures in the first component and also to permit a through flow of air, the first and second components being mounted adjacent each other and being movable relative to each other such that the apertures can be moved between positions of differing degrees of alignment to regulate a flow of air through the two components, means being provided for releasably fixing the first and second components relative to each other to give a desired degree of alignment between the apertures in the first and second components and thereby give a desired air flow rate, said releasable fixing means permitting removal of one component from its position adjacent the other component for maintenance or the like purposes, the fixing means being such that the removed component can only be replaced in the same position relative to the other component as that from which it was removed thereby ensuring that the desired air flow rate setting is maintained.

13. An apparatus according to Claim 12 wherein the releasable fixing means comprise a peg mountable at one of a plurality of positions on the first component, the locations corresponding to different degrees of alignment between the apertures in the first and second components and an opening in part of the second component, the arrangement being such that when the peg is mounted at one of said locations on the first component part of the peg projects upwardly such that the second component can only be mounted adjacent the first component in one predetermined position in which the projecting part of the peg extends into the opening formed in the second component.

14. An apparatus according to Claim 13 wherein the

plurality of locations defined by the first component comprise a plurality of dovetail sectioned slots and the peg comprises a dovetail-sectioned peg designed to be received in the slots, the peg having a head which projects beyond the end of the slot to form the projecting portion which is received within the opening in the second component.

15. An apparatus according to Claim 13 or Claim 14 wherein the plurality of locations at which the peg may be mounted on the first component are off-set from one another by a differing amount to that by which the apertures in the first and second components are off-set from one another such that the repositioning of the peg from one location to the next provides a change in the degree of alignment of the apertures in the first and second components.

16. An apparatus for directing a flow of air from an outlet of a heating, ventilating or air conditioning system, the apparatus comprising a plenum chamber and one or more further components disposed between the plenum chamber and the outlet, the plenum chamber having an inlet adapted to be connected to ducting of the heating, ventilating or air conditioning system so as to receive air supplied via the ducting, the plenum chamber also having an outlet through which air flows from the chamber to a further component forming part of the apparatus, the plenum chamber and the further component having co-operating means forming a substantially airtight snap fitting connection between the outlet of the plenum chamber and the further component.

17. An apparatus according to Claim 16 wherein the means forming the substantially airtight snap fitting connection between the outlet of the plenum chamber and the further component comprise a co-operating resilient lip and a step or recess formed on the plenum chamber and the further component, movement of the plenum chamber and the further component into engagement with each other serving automatically to cause the lip to become captively engaged behind the step or recess thereby connecting the outlet of the plenum chamber to the further component.

18. An apparatus according to Claim 17 wherein the lip is formed around the periphery of the plenum chamber outlet and the step is defined by the further component to which the plenum chamber is to be connected.

19. An apparatus according to Claim 18 wherein the plenum chamber has a substantially circular outlet and the step or recess is defined in an outwardly directed surface of a corresponding, annular part of the further component, the annular part of the further component widening in the direction in which the plenum chamber is moved into engagement therewith such that the resilient lip flexes outwardly as the plenum chamber and the further component are moved together prior to snap-fitting into the step or recess.

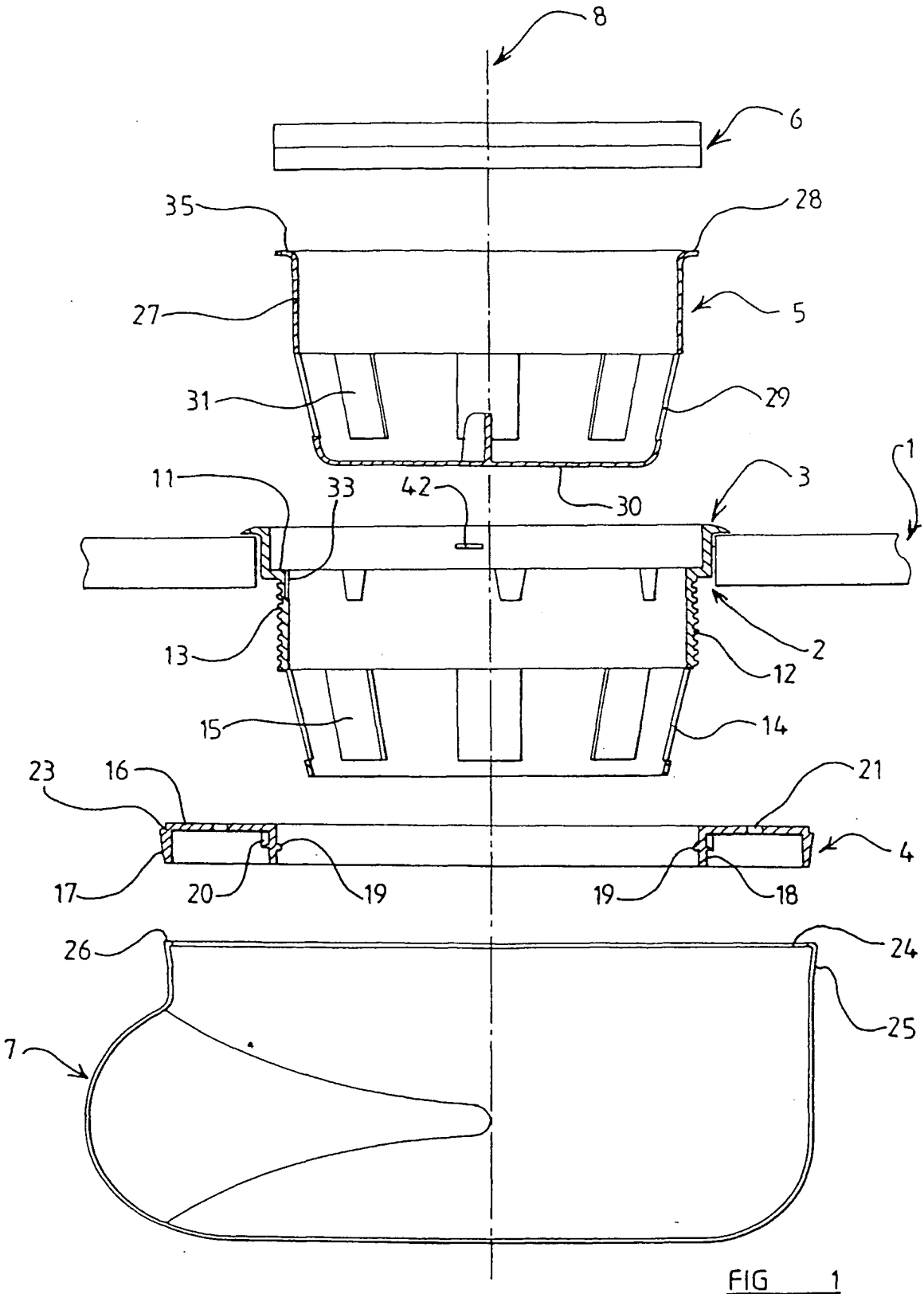
8
6
35
28
27
5
31
29
1
11
33
42
30
3
13
2
12
15
14
23
16
21
4
17
20
19
19
18
26
24
25
7

FIG 1

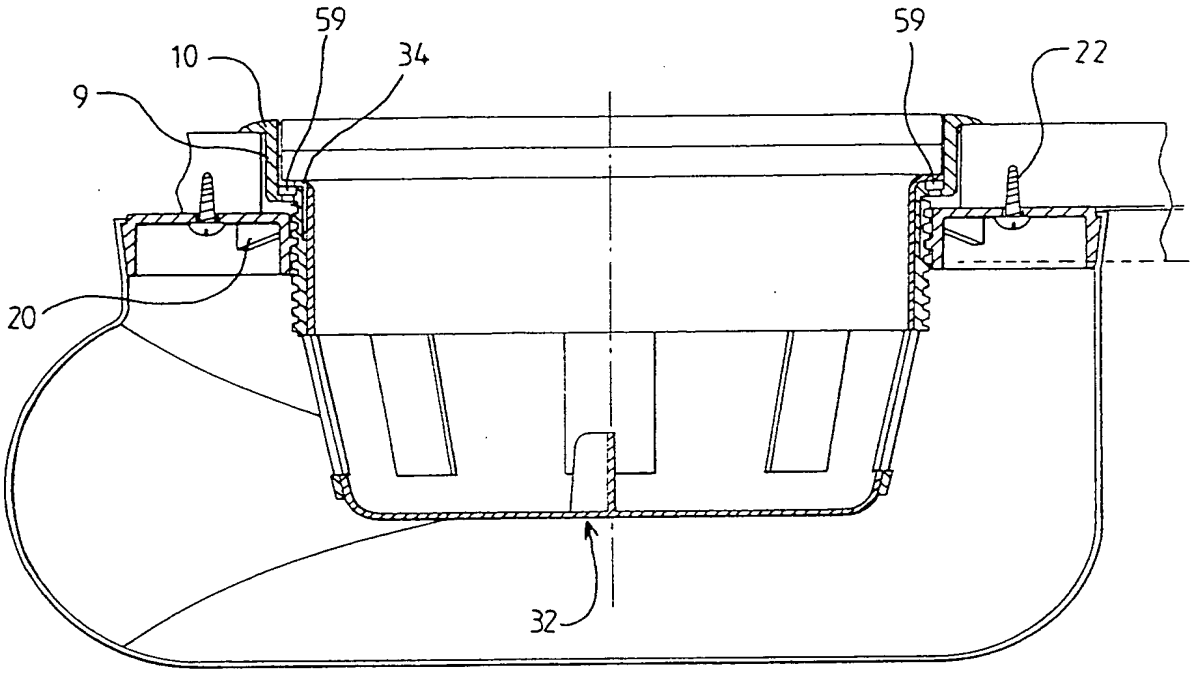

FIG 2

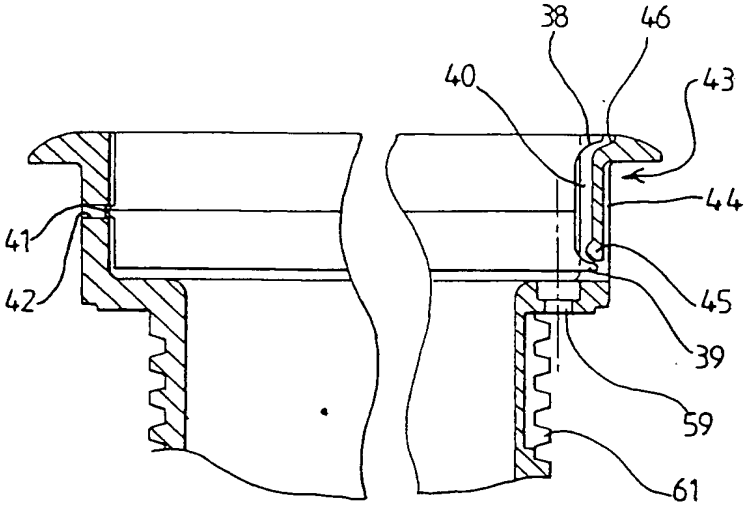

FIG 4

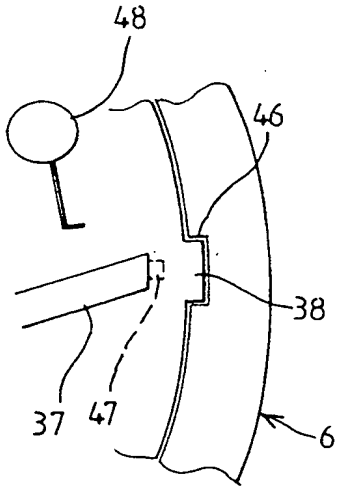

FIG 5

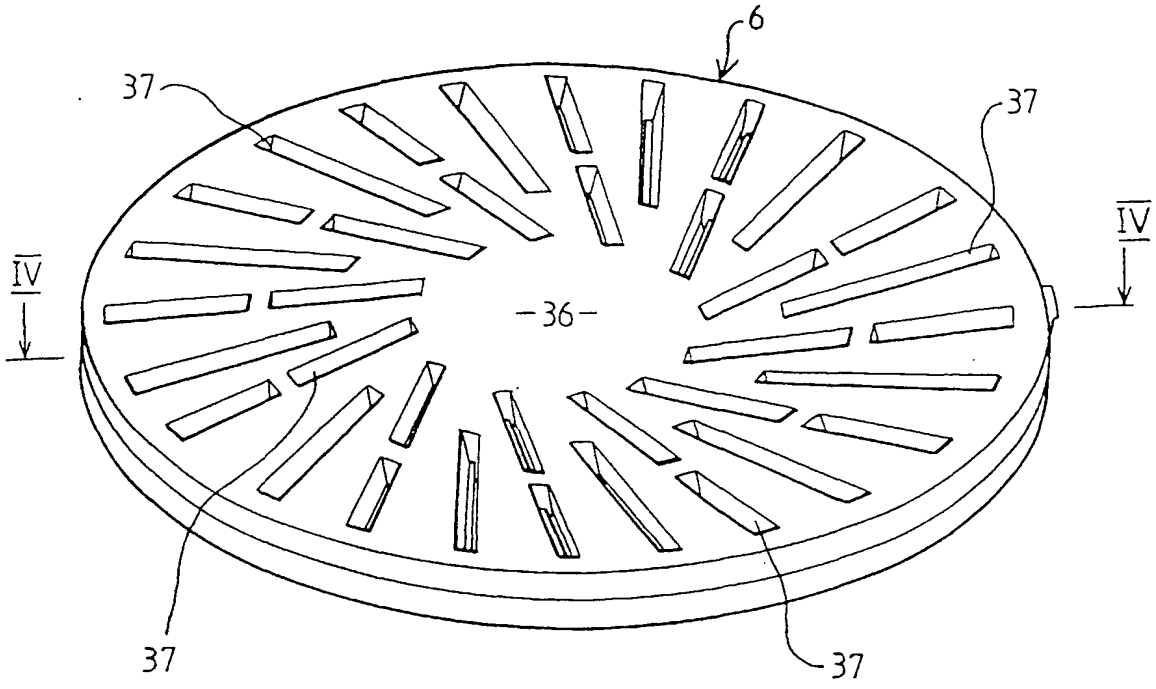

FIG 3

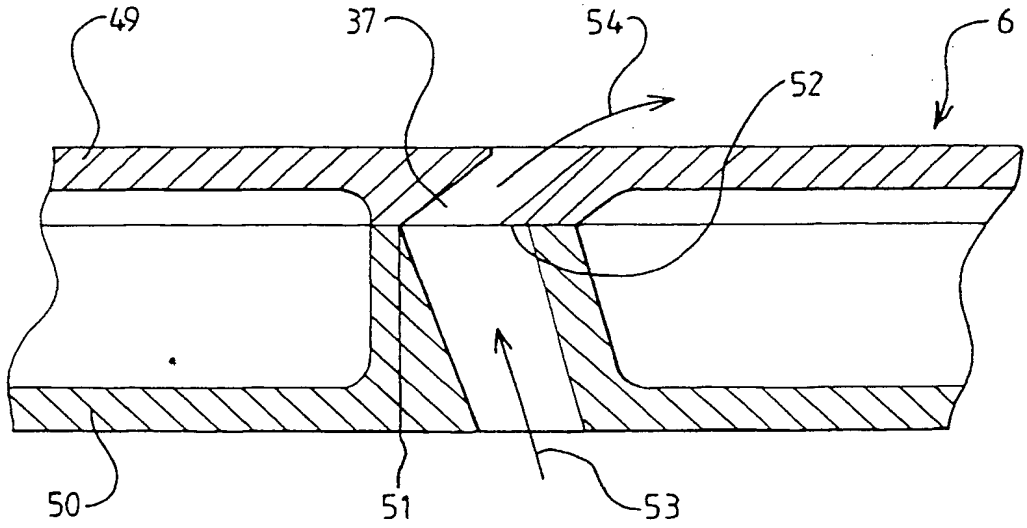

FIG 6

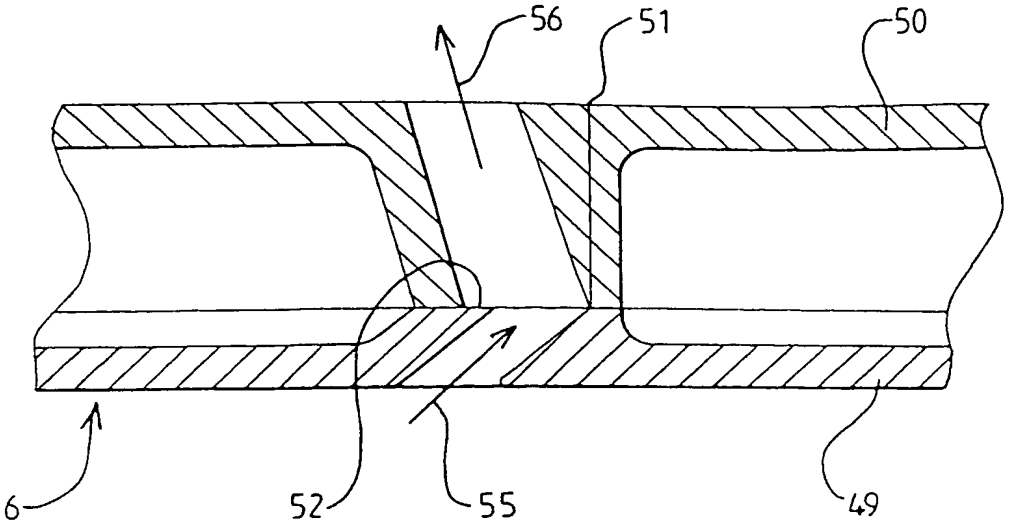

FIG 7

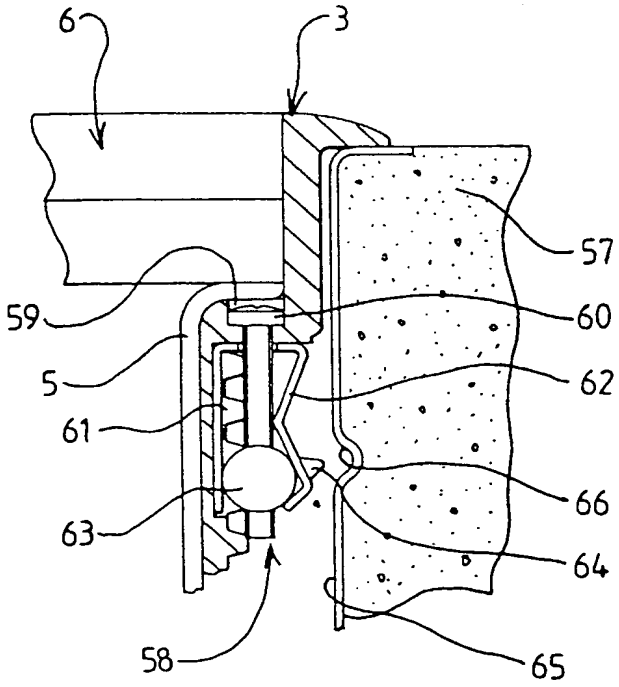

FIG 8

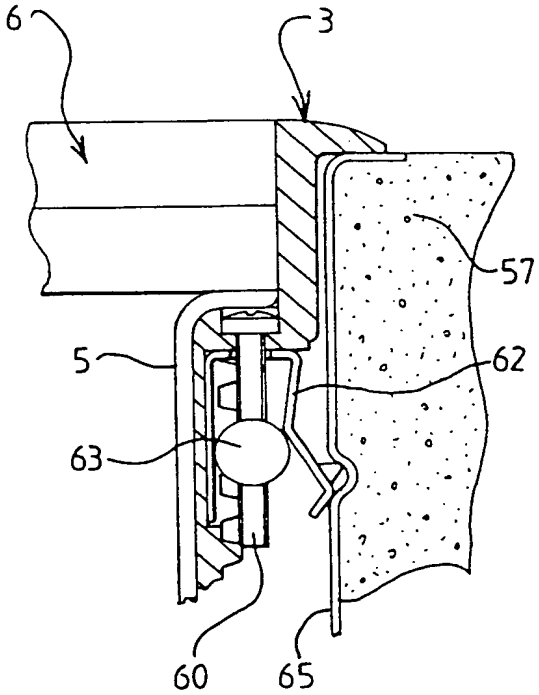

FIG 9